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(54) INFORMATION PROCESSING DEVICE AND INFORMATION PROCESSING METHOD

INFORMATIONSPERARBEITUNGSVORRICHTUNG UND
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DISPOSITIF DE TRAITEMENT D'INFORMATIONS ET PROCÉDÉ DE TRAITEMENT
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(56) References cited:
WO-A2-2018/101552 JP-A- 2006 284 458
JP-A- 2012 153 256 JP-A- 2013 108 852
JP-A- 2017 151 637 JP-A- 2019 012 236
JP-A- 2019 059 248 US-A1- 2016 159 280
US-A1- 2017 187 963

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Description**BRIEF DESCRIPTION OF DRAWINGS****TECHNICAL FIELD****[0008]**

[0001] The present invention relates to an information processing device and an information processing method.

BACKGROUND ART

[0002] Patent document WO 2018/070193 discloses a head-up display device that makes it easier for the user to recognize important information while driving by displaying an AR (Augmented Reality) guide in a display area visible through a windshield from a driver's seat of a vehicle such that the AR guide is superimposed and displayed in the real world.

[0003] Other examples of head-up display devices are described in patent documents JP 2019 012236 A, JP 2006 284458 A, WO 2018/101552 A2 and US 2016/159280 A1.

SUMMARY OF INVENTION**TECHNICAL PROBLEM**

[0004] According to the invention described in patent document WO 2018/070193, as a result of the AR guide being superimposed and displayed in the real world, there is a possibility that the user's attention to the real world may be lowered by the AR guide. As a result, there is a problem that the user of the vehicle may be delayed in noticing the change in the driving environment in the real world.

[0005] The present invention has been made in view of the above problems, and an object of the present invention is to provide an information processing device and an information processing method that can suppress a user's attention to the real world from being lowered by the AR guide, and that can make the user of the vehicle easily notice the change in the driving environment in the real world.

SOLUTION TO PROBLEM

[0006] An information processing device and an information processing method according to the invention are defined in the enclosed appended independent claims. Specific embodiments are defined in the dependent claims.

ADVANTAGEOUS EFFECTS OF INVENTION

[0007] According to the present invention, the user's attention to the real world can be suppressed from being lowered by the AR guide, and the user of the vehicle can easily notice the change in the driving environment in the real world.

[Fig. 1] Fig. 1 is a block diagram illustrating a configuration of an information processing device according to an embodiment of the present invention. [Fig. 2] Fig. 2 is a flowchart illustrating a processing of the information processing device according to the embodiment of the present invention. [Fig. 3A] Fig. 3A is a diagram illustrating a first example of the display of the AR guide. [Fig. 3B] Fig. 3B is a diagram illustrating a second example of the display of the AR guide.

DESCRIPTION OF EMBODIMENTS

[0009] Hereinafter, embodiments of the present invention will be described with reference to the drawings. In the description of the drawings, the same items are designated by the same reference numerals and duplicate description will be omitted.

[Configuration of information processing device]

[0010] A configuration example of the information processing device according to the present embodiment will be described with reference to Fig. 1. The information processing device is mounted on a vehicle as an example. As shown in Fig. 1, the information processing device includes an acquisition unit 25, a display unit 21, and a controller 100.

[0011] The acquisition unit 25 is connected to the controller 100 and acquires information of an object located in surrounding of the vehicle (object information) and information of a route on which the vehicle is scheduled to travel (route information).

[0012] More specifically, the acquisition unit 25 is connected to a plurality of object detection sensors mounted on the vehicle, such as a laser radar, a millimeter wave radar, and a camera, which detect objects around the vehicle. The object detection sensor detects moving objects including other vehicles, motorcycles, bicycles, pedestrians, and stationary objects including parked vehicles, as objects around the vehicle. For example, the object detection sensor detects the position, attitude (yaw angle), size, speed, acceleration, deceleration, and yaw rate of moving and stationary objects with respect to the vehicle. The acquisition unit 25 acquires information about the moving object and the stationary object detected by the object detection sensor as the object information.

[0013] Further, the acquisition unit 25 is connected to a navigation device (not shown), and acquires, for example, information of a guidance route to the destination of the vehicle as the route information. In addition, the acquisition unit 25 may acquire information such as a road map, the current position of the vehicle, and a point

of interest (POI), which is a place of interest of the user scattered between the vehicle and the destination.

[0014] In addition, the acquisition unit 25 may acquire a captured image obtained by imaging the surrounding of the vehicle.

[0015] The acquisition unit 25 may have a storage unit that stores acquired object information and acquired route information.

[0016] The display unit 21 is connected to the controller 100 and has a display area 23 that is transparent to the surrounding of the vehicle such that the surrounding is visible from a driver's seat of the vehicle. The AR guide (image) generated by the controller 100 is displayed in the display area 23. Therefore, in the display area 23, the AR guide is displayed superimposed on the scenery around the vehicle.

[0017] For example, the display unit 21 may be a head-up display device, a head-mounted display, smart glasses, or a prompter.

[0018] The display area 23 may be a windshield of the vehicle, and the AR guide may be projected onto the display area 23 from a projector (not shown) to present the AR guide to the user. As a result, the user will see the AR guide superimposed on the scenery around the vehicle that can be seen through the windshield.

[0019] The AR guide presented by the display unit 21 expresses, for example, a guide route to the destination of the vehicle, a road map, the current position of the vehicle, and a point of interest (POI) of the user scattered between the vehicle and the destination, and the like.

[0020] The display unit 21 may display the AR guide by superimposing it on the captured image acquired by the acquisition unit 25. In this case, the display area 23 may be a display capable of displaying the captured image and the AR guide instead of being transparent to the surrounding such that the surrounding is visible from the driver's seat of the vehicle.

[0021] The controller 100 is a general-purpose computer including a CPU (Central Processing Unit), a memory, a storage device, an input / output unit, and the like. The controller 100 is connected to a navigation device (not shown). For example, the navigation device performs route guidance of the vehicle.

[0022] The controller 100 (control unit) is a general-purpose microcomputer including a CPU (central processing unit), a memory, and an input / output unit. A computer program for functioning as the information processing device is installed in the controller 100. By executing the computer program, the controller 100 functions as a plurality of information processing circuits (110, 120, 130, 140) included in the information processing device. The computer program may be stored in a recording medium that can be read and written by a computer.

[0023] In the present embodiment, an example is shown in which the plurality of information processing circuits (110, 120, 130, 140) are realized by software. However, it is also possible to configure information processing circuits (110, 120, 130, 140) by preparing

dedicated hardware for executing each of the following information processing. Further, the plurality of information processing circuits (110, 120, 130, 140) may be configured by individual hardware. Further, the information processing circuit (110, 120, 130, 140) may also be used as a navigation device or a control unit used for controlling a vehicle.

[0024] As shown in Fig. 1, the controller 100 includes an object extraction unit 110, a determination unit 120, an image generation unit 130, and an output unit 140 as the plurality of information processing circuits (110, 120, 130, 140).

[0025] The object extraction unit 110 extracts an object that may interfere with the traveling of the vehicle based on the object information and the route information. For example, the object extraction unit 110 extracts an object existing within a predetermined distance from the vehicle or within a predetermined distance from the route on which the vehicle is scheduled to travel. Here, the predetermined distance is set in advance.

[0026] Note that different predetermined distances may be set according to the type of the object. For example, the predetermined distance set for the object having a high moving speed may be set longer than the predetermined distance set for the object having a low moving speed. The predetermined distance set when extracting other vehicles, motorcycles, and bicycles may be set longer than the predetermined distance set when extracting pedestrians and parked vehicles.

[0027] In addition, the object extraction unit 110 may extract an object that exists within the predetermined distance from the vehicle or within the predetermined distance from the route on which the vehicle is scheduled to travel and is located forward with respect to the direction in which the vehicle travels.

[0028] The object extraction unit 110 may extract an object located in a range visible from the driver's seat of the vehicle via the display area 23.

[0029] The determination unit 120 determines whether the object interferes with a travelling of the vehicle based on the object information and the route information for the object extracted by the object extraction unit 110.

[0030] For example, the determination unit 120 may determine whether the object approaches the vehicle or the route on which the vehicle is scheduled to travel, and in a case of determining that the object approaches the vehicle or the route, the determination unit 120 may determine that the object interferes with the travelling of the vehicle.

[0031] The determination unit 120 may predict the distance between the object and the vehicle after a unit time has elapsed, based on the object information and the route information. Then, the determination unit 120 may determine that the object approaches the vehicle when the distance between the object and the vehicle after a unit time elapses is smaller than the distance between the current object and the vehicle.

[0032] The determination unit 120 may predict the

distance between the object and the route on which the vehicle is scheduled to travel after a unit time has elapsed, based on the object information and the route information. Then, in a case that the distance between the object and the route after a unit time elapses is smaller than the distance between the current object and the route, the determination unit 120 may determine that the object approaches the route on which the vehicle plans to travel.

[0033] Further, the determination unit 120 may determine whether the object is shielded by the AR guide displayed in the display area 23 when viewed from the driver's seat, and in a case of determining that the object is shielded by the AR guide, the determination unit 120 may determine that the object interferes with the travelling of the vehicle.

[0034] Further, the determination unit 120 may determine whether the distance visually recognized in the display area 23 between an appearance of the object and the AR guide when viewed from the driver's seat (distance on the display area 23) is equal to or less than a predetermined distance. Then, the determination unit 120 may determine that the object interferes with the travelling of the vehicle in a case that the distance between the appearance of the object and the AR guide is equal to or less than the predetermined distance.

[0035] The predetermined distance may be set based on the size of the appearance of the object in the display area 23 and the size of the AR guide. For example, the predetermined distance set when the size of the appearance of the object is small may be set larger than the predetermined distance set when the size of the appearance of the object is large. Further, the predetermined distance set when the ratio of the size of the appearance of the object to the size of the AR guide is small may be set larger than the predetermined distance set when the ratio of the size of the appearance of the object to the size of the AR guide is large.

[0036] Further, the determination unit 120 may calculate a collision time between the object and the vehicle based on the object information and the route information, and may determine whether the collision time is equal to or less than a predetermined time. Then, the determination unit 120 may determine that the object interferes with the travelling of the vehicle in a case of determining that the collision time is equal to or less than the predetermined time. Here, the collision time between the object and the vehicle is calculated based on the moving speed and the moving direction of the object, and the moving speed and the moving direction of the vehicle.

[0037] Further, the determination unit 120 may determine whether a speed of the vehicle is equal to or higher than the predetermined speed and may determine that the object interferes with the travelling of the vehicle in a case of determining that the speed of the vehicle is equal to or higher than the predetermined speed.

[0038] Further, the determination unit 120 determines whether a speed of the object is equal to or higher than

the predetermined speed based on the object information and may determine that the object interferes with the travelling of the vehicle in a case of determining that the speed of the object is equal to or higher than the predetermined speed.

[0039] The image generation unit 130 generates the AR guide based on the route information. For example, the image generation unit 130 generates the AR guide that is visually recognized in the display area 23 when viewed from the driver's seat and overlaps with the image of the route on which the vehicle is scheduled to travel.

[0040] Figs. 3A and 3B illustrate examples of AR guides generated so as to overlap the image of the route on which the vehicle is scheduled to travel. Fig. 3A is a diagram illustrating a first example of the display of the AR guide. Fig. 3B is a diagram illustrating a second example of the display of the AR guide. In Figs. 3A and 3B, it is assumed that a left turn is planned at an intersection located in front of a lane in which the vehicle travels.

[0041] Fig. 3A shows how the AR guides AR1 to AR7 are displayed in the display area 23 along the image TL of the route on which the vehicle is scheduled to travel. Therefore, the user can recognize the route on which the vehicle plans to travel along the AR guides AR1 to AR7.

[0042] Fig. 3B shows how the AR guides AR1 to AR5 are displayed in the display area 23 along the image TL of the route on which the vehicle is scheduled to travel. Unlike Fig. 3A, the AR guide AR6 and AR guide AR7 are not shown because of the presence of another vehicle VC.

[0043] When another vehicle VC become to be able to visually recognize via the display area 23, the image generation unit 130 changes the AR guide from the state of Fig. 3A to the state of Fig. 3B.

[0044] That is, in a case that the object extracted by the object extraction unit 110 exists, the image generation unit 130 change part or all of the AR guide to increase a ratio of the display area 23 that allows the surrounding of the vehicle to pass through. Further, in a case that there is the object that interferes with the traveling of the vehicle determined by the determination unit 120, the image generation unit 130 change part or all of the AR guide to increase the ratio of the display area 23 that allows the surrounding of the vehicle to pass through.

[0045] Further, the image generation unit 130 may increase transmittance of part or all of the AR guide to increase the ratio of the display area 23 that allows the surrounding of the vehicle to pass through. Further, the image generation unit 130 may set the transmittance of part or all of the AR guide as 100% to increase the ratio of the display area 23 that allows the surrounding of the vehicle to pass through. According to Figs. 3A and 3B, another vehicle VC shown in Fig. 3B may be made visible by increasing the transmittance of the AR guide AR6 and the AR guide AR7.

[0046] Further, the image generation unit 130 may increase the ratio of the display area 23 that allows the

surrounding of the vehicle to pass through by reducing a size of part or all of the AR guide. According to Figs. 3A and 3B, in the state after the size change (Fig. 3B) as compared with the state before the size change (Fig. 3A), the size of a part or all of the AR guides AR1 to AR7 (for example, height or width) is reduced. As a result, another vehicle VC shown in Fig. 3B can be easily visually recognized.

[0047] Further, the image generation unit 130 may increase the ratio of the display area 23 that allows the surrounding of the vehicle to pass through by reducing a width of the AR guide showing the route on which the vehicle is scheduled to travel, the width is along a width direction of a road on which the vehicle travels. According to Figs. 3A and 3B, as compared with the width W1 of the AR guide along the road width direction in the state before the size is changed (Fig. 3A), the width W2 of the AR guide along the road width direction in the state after the size is changed (Fig. 3B) becomes small. As a result, another vehicle VC shown in Fig. 3B can be easily visually recognized.

[0048] Further, the image generation unit 130 may increase the ratio of the display area 23 that allows the surrounding of the vehicle to pass through by reducing a length of the AR guide showing the route on which the vehicle is scheduled to travel, the length is along a direction in which the vehicle travels.

[0049] According to Figs. 3A and 3B, as compared with the height H1 of the AR guide along the direction in which the vehicle travels in the state before the size change (Fig. 3A), the height H2 of the AR guide along the direction in which the vehicle travels in the state after the size change (Fig. 3B) becomes small. As a result, another vehicle VC shown in Fig. 3B can be easily visually recognized.

[0050] Further, as compared with the total length of the AR guide (the length from the AR guide AR1 to the AR guide AR7) along the direction in which the vehicle travels in the state of Fig. 3A, the total length of the AR guide (the length from the AR guide AR1 to the AR guide AR5) along the direction in which the vehicle travels in the state of Fig. 3B is reduced. As a result, another vehicle VC shown in Fig. 3B can be easily visually recognized.

[0051] Further, the image generation unit 130 may increase the ratio of the display area 23 that allows the surrounding of the vehicle to pass through by approximating a color of part or all of the AR guide to a color of the surrounding of the vehicle. For example, the image generation unit 130 may acquire the color of the surrounding of the vehicle based on the captured image.

[0052] According to Figs. 3A and 3B, by bringing the colors of the AR guides AR1 to AR7 closer to the colors around the vehicle as the background in the display area 23, another vehicle VC shown in Fig. 3B can be visually recognized. Further, the colors of the AR guide AR6 and the AR guide AR7 in Fig. 3A may be approximated to the color of another vehicle VC in Fig. 3B.

[0053] By bringing the color of a part or all of the AR

guide closer to the color around the vehicle, the AR guide becomes inconspicuous in the display area 23, and the object visible through the display area 23 becomes relatively conspicuous. As a result, according to Fig. 3B, another vehicle VC can be easily visually recognized.

[0054] In addition, for example, in an RGB color model (a model that expresses colors with the three primary colors of red, green, and blue), "approximating color" means making an RGB values of the AR guide closer to an RGB values of the image of the surrounding of the vehicle reflected in the display area 23.

[0055] In addition, in a case that the object extracted by the object extraction unit 110 does not exist, the image generation unit 130 may decrease the ratio of the display area 23 that allows the surrounding of the vehicle to pass through by changing a part or all of the AR guide. Further, in a case that there is no object that interferes with the traveling of the vehicle by the determination unit 120, the image generation unit 130 may decrease the ratio of the display area 23 that allows the surrounding of the vehicle to pass through by changing a part or all of the AR guide.

[0056] According to Figs. 3A and 3B, in a case that another vehicle VC runs away and becomes invisible through the display area 23, the image generation unit 130 may decrease the ratio of the display area 23 that allows the surrounding of the vehicle to pass through by changing the AR guide from the state of Fig. 3B to the state of Fig. 3A. This makes the AR guide easily visible.

[0057] The output unit 140 outputs the AR guide generated / changed by the image generation unit 130. The output AR guide is displayed in the display area 23.

[Processing procedure of the information processing device]

[0058] Next, the processing procedure of the information processing device according to the present embodiment will be described with reference to the flowchart of Fig. 2. The processing of the information processing device shown in Fig. 2 may be started based on a user's instruction or may be repeatedly executed at a predetermined cycle.

[0059] First, in step S101, the acquisition unit 25 acquires the object information and the route information. The acquired object information and the acquired route information are transmitted to the controller 100.

[0060] In step S103, the image generation unit 130 generates an AR guide based on the route information.

[0061] In step S105, the object extraction unit 110 extracts an object that may interfere with the traveling of the vehicle based on the object information and the route information. Then, the determination unit 120 determines whether the object interferes with the travelling of the vehicle based on the object information and the route information for the object extracted by the object extraction unit 110.

[0062] If it is determined that the object interferes with the travelling of the vehicle (YES in step S107), the image

generation unit 130 changes the AR guide in step S109. More specifically, the image generation unit 130 modifies a part or all of the AR guide to increase the ratio of the display area 23 that allows the surrounding of the vehicle to pass through. Then, the process proceeds to step S111.

[0063] On the other hand, if it is determined that the object does not interfere with the traveling of the vehicle (NO in step S107), the process proceeds to step S111.

[0064] In step S111, the output unit 140 outputs the AR guide generated / changed by the image generation unit 130. The output AR guide is displayed in the display area 23.

[Effects of Embodiments]

[0065] As a result of the information processing device and information processing method according to the invention, the user's attention to the real world can be suppressed from being lowered by the AR guide, and the user of the vehicle can easily notice the change in the driving environment in the real world. In addition, the possibility that the object located around the vehicle is shielded by the AR guide is reduced, and the user can easily notice the object, or the behavior change of the object. As a result, the user can perform a faster driving operation corresponding to the change in the behavior of the object.

[0066] Therefore, the user can obtain the driving support from the system by the display of the AR guide, and at the same time, can operate the vehicle without lowering the attention to the objects located around the vehicle.

[0067] Further, the information processing device and the information processing method according to some embodiments may increase transmittance of part or all of the image to increase the ratio of the display area that allows the surrounding to pass through. As a result, the possibility that the object located around the vehicle is shielded by the AR guide is reduced, and the user can easily notice the object, or the behavior change of the object. By controlling the transmittance of the image, the user can pay attention to the objects located around the vehicle while checking the displayed AR guide.

[0068] Further, the information processing device and the information processing method according to some embodiments may set the transmittance as 100% to increase the ratio of the display area that allows the surrounding to pass through. As a result, the object located around the vehicle is suppressed from being shielded by the AR guide, and the user can easily notice the object, or the behavior change of the object. The user can also pay attention to objects located around the vehicle.

[0069] Further, the information processing device and the information processing method according to some embodiments may reduce a size of part or all of the image to increase the ratio of the display area that allows the surrounding to pass through. As a result, the object

located around the vehicle is suppressed from being shielded by the AR guide.

[0070] Further, the information processing device and the information processing method according to the some embodiments may reduce a width of the image showing the route to increase the ratio of the display area that allows the surrounding to pass through, wherein the width is along a width direction of a road on which the vehicle travels. This makes it easier for the user to notice an object located on the side of the road on which the vehicle travels and a change in the behavior of the object. In particular, the user is more likely to notice an object popping out from the side of the road on which the vehicle travels. As a result, the user can perform a faster driving operation corresponding to an object popping out from the side of the road.

[0071] Further, the information processing device and the information processing method according to some embodiments may reduce a length of the image showing the route to increase the ratio of the display area that allows the surrounding to pass through, wherein the length is along a direction in which the vehicle travels. This makes it easier for the user to notice an object located in front of the vehicle along the direction in which the vehicle travels and a change in the behavior of the object. As a result, the user can perform a faster driving operation corresponding to the object located in front of the vehicle.

[0072] Further, the information processing device and the information processing method according to the some embodiments may approximate a color of part or all of the image to a color of the surrounding to increase the ratio of the display area that allows the surrounding to pass through. This prevents the user's attention to objects located around the vehicle from being reduced by the AR guide. Furthermore, the user can easily notice the change in the behavior of the object. As a result, the user can perform a faster driving operation corresponding to the change in the behavior of the object.

[0073] Further, the information processing device and the information processing method according to the invention determine whether the object interferes with a travelling of the vehicle based on the information and increase the ratio in a case of determining that the object interferes with the travelling of the vehicle. This makes it possible to extract an object which driving operation of the vehicle needs to be changed in order to avoid the running of the vehicle from being interfered with. Therefore, the user can easily notice the object, and the user can perform a faster driving operation corresponding to the behavior of the object for which driving operation of the vehicle needs to be changed.

[0074] Further, the information processing device and the information processing method according to some embodiments may determine whether the object approaches the vehicle or the route and may determine that the object interferes with the travelling of the vehicle in a case of determining that the object approaches the

vehicle or the route. As a result, it is possible to accurately extract an object which driving operation of the vehicle needs to be changed in order to avoid the running of the vehicle from being interfered with.

[0075] Further, the information processing device and the information processing method according to some embodiments may determine whether the object is shielded by the image displayed in the display area and may determine that the object interferes with the travelling of the vehicle in a case of determining that the object is shielded by the image. As a result, it is possible to accurately extract an object which driving operation of the vehicle needs to be changed in order to avoid the running of the vehicle from being interfered with. Further, since it is possible to determine whether the object is shielded by the image based on the information on the position of the object without using the information on the velocity of the object, the calculation cost for extracting the object can be reduced.

[0076] Further, the information processing device and the information processing method according to some embodiments may calculate a collision time between the object and the vehicle, may determine whether the collision time is equal to or less than a predetermined time, and may determine that the object interferes with the travelling of the vehicle in a case of determining that the collision time is equal to or less than the predetermined time. As a result, it is possible to accurately extract an object which driving operation of the vehicle needs to be changed in order to avoid the running of the vehicle from being interfered with.

[0077] Further, the information processing device and the information processing method according to the some embodiments may determine whether a speed of the vehicle is equal to or higher than a predetermined speed and may determine that the object interferes with the travelling of the vehicle in a case of determining that the speed of the vehicle is equal to or higher than the predetermined speed. As a result, it is possible to accurately extract an object which driving operation of the vehicle needs to be changed in order to avoid the running of the vehicle from being interfered with. Further, since it is possible to determine whether the object is shielded by the image based on the information on the speed of the object without using the information on the position of the object, the calculation cost for extracting the object can be reduced.

[0078] Further, the information processing device and the information processing method according to the some embodiments may decrease the ratio in a case of determining that the object does not interfere with the travelling of the vehicle. As a result, the smaller the number of objects that interfere with the running of the vehicle, the smaller the ratio of the display area that allows the surrounding to pass through. As a result, it is possible to maximize the effect of the driving support that the user receives from the system by displaying the AR guide.

[0079] Respective functions described in the above embodiment may be implemented by one or plural processing circuits. The processing circuits include programmed processors, electrical circuits, etc., as well as devices such as application specific integrated circuits (ASIC) and circuit components arranged to perform the described functions, etc.

[0080] Although the contents of the present invention have been described above with reference to some embodiments, the device and method according to the invention are defined by the claims and are not limited to the foregoing descriptions. In other words, it should not be construed that the claimed invention is limited to the descriptions and the drawings that constitute a part of the present disclosure. On the basis of the present disclosure, various alternative embodiments, practical examples and operating techniques will be apparent to those skilled in the art, and the present invention includes various embodiments that are covered by the claims although not described herein.

REFERENCE SIGNS LIST

[0081]

21	display unit
23	display area
25	acquisition unit
100	controller
110	object extraction unit
120	determination unit
130	image generation unit
140	output unit

Claims

1. An information processing device including a display unit (21), an acquisition unit (25), and a controller (100), wherein:

the acquisition unit (25) is configured to acquire information of

an object located in surrounding of a vehicle, and
a route on which the vehicle is scheduled to travel; and

the display unit (21) includes a display area (23) that is transparent to the surrounding such that the surrounding is visible from a driver's seat of the vehicle, and is configured to display an image (AR1-AR7) superimposed on the display area (23),

characterized in that, when the controller (100) generates the image (AR1-AR7) based on the route, the controller (100) is configured to:

- based on the information, determine that the object interferes with the travelling of the vehicle in a case of determining that a visual distance on the display area (23) between an appearance of the object viewed from the driver's seat and the image (AR1-AR7) is equal to or less than a predetermined visual distance, the predetermined visual distance being based on a size of the appearance of the object on the display area (23) and/or a size of the image (AR1-AR7) on the display area (23); and increase a ratio of the display area (23) that allows the surrounding to pass through by changing part or all of the image (AR1-AR7) in a case of determining that the object interferes with the travelling of the vehicle.
2. The information processing device according to claim 1, wherein the controller (100) is configured to determine that the object interferes with the travelling of the vehicle in a case of determining that a calculated collision time between the object and the vehicle is equal to or less than a predetermined time.
 3. The information processing device according to claim 1 or 2, wherein the controller (100) is configured to determine that the object interferes with the travelling of the vehicle in a case of determining that a speed of the vehicle is equal to or higher than a predetermined speed.
 4. The information processing device according to any one of claims 1 to 3, wherein

when the controller (100) generates the image (AR1-AR7) based on the route, the controller (100) is configured to

determine whether the object approaches the route, based on the information, determine that the object interferes with the travelling of the vehicle in a case of determining that the object approaches the route.
 5. The information processing device according to any one of claims 1 to 4, wherein the controller (100) is configured to increase transmittance of part or all of the image (AR1-AR7).
 6. The information processing device according to claim 5, wherein the controller (100) is configured to set the transmittance as 100%.
 7. The information processing device according to any one of claims 1 to 6, wherein
- the controller (100) is configured to reduce a size of part or all of the image (AR1-AR7).
8. The information processing device according to claim 7, wherein the controller (100) is configured to reduce a width (W1) of the image (AR1-AR7) showing the route, the width (W1) being along a width direction of a road on which the vehicle travels.
 9. The information processing device according to claim 7 or 8, wherein the controller (100) is configured to reduce a length (H1) of the image (AR1-AR7) showing the route, the length (H1) being along a direction in which the vehicle travels.
 10. The information processing device according to any one of claims 1 to 9, wherein the controller (100) is configured to approximate a color of part or all of the image (AR1-AR7) to a color of the surrounding.
 11. The information processing device according to any one of claims 1 to 10, wherein the controller (100) is configured to

determine whether the object is shielded by the image (AR1-AR7) displayed in the display area (23), and

determine that the object interferes with the travelling of the vehicle in a case of determining that the object is shielded by the image (AR1-AR7).
 12. The information processing device according to any one of claims 1 to 11, wherein the controller (100) is configured to decrease the ratio in a case of determining that the object does not interfere with the travelling of the vehicle.
 13. An information processing method for controlling a display unit (21) including a display area (23) that is transparent to surrounding of a vehicle such that the surrounding is visible from a driver's seat of the vehicle, comprising:

acquiring information of

an object located in the surrounding of a vehicle, and

a route on which the vehicle is scheduled to travel,

characterized in that the method further comprises, when generating an image (AR1-AR7) displayed and superimposed on the display area (23) based on the route:

based on the information, determining that the object interferes with the travelling of the vehicle in a case of determining that a visual distance on the display area (23) between an appearance of the object viewed from the driver's seat and the image (AR1-AR7) is equal to or less than a predetermined visual distance, the predetermined visual distance being based on a size of the appearance of the object on the display area (23) and/or a size of the image (AR1-AR7) on the display area (23); and increasing a ratio of the display area (23) that allows the surrounding to pass through by changing part or all of the image (AR1-AR7) in a case of determining that the object interferes with the travelling of the vehicle.

Patentansprüche

1. Eine Vorrichtung zur Informationsverarbeitung, aufweisend eine Anzeigeeinheit (21), eine Erwerbungs-
einheit (25), und einen Controller (100), wobei:

die Erwerbungs-
einheit (25) dazu ausgeführt ist,
Informationen zu erwerben
von einem Objekt, das sich in der Umgebung
eines Fahrzeugs befindet, und einer Route, auf
der das Fahrzeug fahren soll; und
die Anzeigeeinheit (21) einen Anzeigebereich
(23) umfasst, der für die Umgebung transparent
ist, so dass die Umgebung vom Fahrersitz des
Fahrzeugs aus sichtbar ist, und dazu ausgeführt
ist, ein Bild (AR1-AR7) überlagert auf dem An-
zeigebereich (23) anzuzeigen,
dadurch gekennzeichnet, dass, wenn der
Controller (100) das Bild (AR1-AR7) auf der
Basis der Route erzeugt, der Controller (100)
dazu ausgeführt ist:

auf der Basis der Informationen festzustel-
len, dass das Objekt die Fahrt des Fahr-
zeugs beeinträchtigt, in einem Fall, in dem
festgestellt wird, dass ein visueller Abstand
auf dem Anzeigebereich (23) zwischen ei-
nem Erscheinungsbild des Objekts, gese-
hen vom Fahrersitz aus, und dem Bild
(AR1-AR7) gleich oder kleiner als ein vor-
bestimmter visueller Abstand ist, wobei der
vorbestimmte visuelle Abstand auf einer
Größe des Erscheinungsbildes des Objekts
auf dem Anzeigebereich (23) und/oder ei-
ner Größe des Bildes (AR1-AR7) auf dem
Anzeigebereich (23) basiert; und
ein Verhältnis des Anzeigebereichs (23),
das das Durchlassen der Umgebung er-
möglicht, zu erhöhen, indem ein Teil oder

das gesamte Bild (AR1-AR7) geändert
wird, in einem Fall, in dem festgestellt wird,
dass das Objekt die Fahrt des Fahrzeugs
beeinträchtigt.

2. Die Vorrichtung zur Informationsverarbeitung ge-
mäß Anspruch 1, wobei
der Controller (100) dazu ausgeführt ist festzustel-
len, dass das Objekt die Fahrt des Fahrzeugs be-
einträchtigt, in einem Fall, in dem festgestellt wird,
dass eine berechnete Kollisionszeit zwischen dem
Objekt und dem Fahrzeug gleich oder kleiner als
eine vorbestimmte Zeit ist.
3. Die Vorrichtung zur Informationsverarbeitung ge-
mäß Anspruch 1 oder 2, wobei
der Controller (100) dazu ausgeführt ist festzustel-
len, dass das Objekt die Fahrt des Fahrzeugs be-
einträchtigt, in einem Fall, in dem festgestellt wird,
dass eine Geschwindigkeit des Fahrzeugs gleich
oder größer als eine vorbestimmte Geschwindigkeit
ist.
4. Die Vorrichtung zur Informationsverarbeitung ge-
mäß einem der Ansprüche 1 bis 3, wobei
wenn der Controller (100) das Bild (AR1-AR7) auf
der Basis der Route erzeugt, der Controller (100)
dazu ausgeführt ist
festzustellen, ob sich das Objekt der Route nä-
hert, auf der Basis der Informationen,
festzustellen, dass das Objekt die Fahrt des
Fahrzeugs beeinträchtigt, in einem Fall, in
dem festgestellt wird, dass sich das Objekt
der Route nähert.
5. Die Vorrichtung zur Informationsverarbeitung ge-
mäß einem der Ansprüche 1 bis 4, wobei
der Controller (100) dazu ausgeführt ist, die Trans-
mittanz eines Teils oder des gesamten Bildes (AR1-
AR7) zu erhöhen.
6. Die Vorrichtung zur Informationsverarbeitung ge-
mäß Anspruch 5, wobei
der Controller (100) dazu ausgeführt ist, die Trans-
mittanz auf 100 % festzulegen.
7. Die Vorrichtung zur Informationsverarbeitung ge-
mäß einem der Ansprüche 1 bis 6, wobei
der Controller (100) dazu ausgeführt ist, eine Größe
eines Teils oder des gesamten Bildes (AR1-AR7) zu
verringern.
8. Die Vorrichtung zur Informationsverarbeitung ge-
mäß Anspruch 7, wobei
der Controller (100) dazu ausgeführt ist, eine Breite
(W1) des Bildes (AR1-AR7), das die Route darstellt,
zu verringern, wobei die Breite (W1) entlang einer

Breitenrichtung einer Straße verläuft, auf der das Fahrzeug fährt.

9. Die Vorrichtung zur Informationsverarbeitung gemäß Anspruch 7 oder 8, wobei
 5 der Controller (100) dazu ausgeführt ist, eine Länge (H1) des Bildes (AR1-AR7), das die Route darstellt, zu verringern, wobei die Länge (H1) entlang einer Richtung verläuft, in der das Fahrzeug fährt.
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10. Die Vorrichtung zur Informationsverarbeitung gemäß einem der Ansprüche 1 bis 9, wobei
 15 der Controller (100) dazu ausgeführt ist, eine Farbe eines Teils oder des gesamten Bildes (AR1-AR7) an eine Farbe der Umgebung anzunähern.
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11. Die Vorrichtung zur Informationsverarbeitung gemäß einem der Ansprüche 1 bis 10, wobei
 25 der Controller (100) dazu ausgeführt ist
 festzustellen, ob das Objekt durch das im Anzeigebereich (23) angezeigte Bild (AR1-AR7) verdeckt ist, und
 festzustellen, dass das Objekt die Fahrt des Fahrzeugs beeinträchtigt, in einem Fall, in dem festgestellt wird, dass das Objekt durch das Bild (AR1-AR7) verdeckt ist.
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12. Die Vorrichtung zur Informationsverarbeitung gemäß einem der Ansprüche 1 bis 11, wobei
 35 der Controller (100) dazu ausgeführt ist, das Verhältnis zu verringern, in einem Fall, in dem festgestellt wird, dass das Objekt die Fahrt des Fahrzeugs nicht beeinträchtigt.
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13. Ein Verfahren zur Informationsverarbeitung zur Steuerung einer Anzeigeeinheit (21), die einen Anzeigebereich (23) umfasst, der für die Umgebung eines Fahrzeugs transparent ist, so dass die Umgebung vom Fahrersitz des Fahrzeugs aus sichtbar ist, aufweisend:
 45 Erwerben von Informationen von einem Objekt, das sich in der Umgebung eines Fahrzeugs befindet, und einer Route, auf der das Fahrzeug fahren soll, **dadurch gekennzeichnet, dass** das Verfahren ferner umfasst, beim Erzeugen eines Bildes (AR1-AR7), das auf dem Anzeigebereich (23) angezeigt und überlagert dargestellt wird, auf der Basis der Route:
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 auf der Basis der Informationen Feststellen, dass das Objekt die Fahrt des Fahrzeugs beeinträchtigt, in einem Fall, in dem festgestellt wird, dass ein visueller Abstand auf dem Anzeigebereich (23) zwischen einem Erscheinungsbild des Objekts, gesehen vom Fahrersitz aus, und dem Bild (AR1-AR7) gleich oder kleiner als ein vorbestimmter visueller Abstand ist, wobei
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der vorbestimmte visuelle Abstand auf einer Größe des Erscheinungsbilds des Objekts auf dem Anzeigebereich (23) und/oder einer Größe des Bildes (AR1-AR7) auf dem Anzeigebereich (23) basiert; und

Erhöhen eines Verhältnisses des Anzeigebereichs (23), das das Durchlassen der Umgebung ermöglicht, durch Ändern eines Teils oder des gesamten Bildes (AR1-AR7) in einem Fall, in dem festgestellt wird, dass das Objekt die Fahrt des Fahrzeugs beeinträchtigt.

Revendications

1. Dispositif de traitement d'informations comprenant une unité d'affichage (21), une unité d'acquisition (25), et un contrôleur (100), dans lequel :

l'unité d'acquisition (25) est configurée pour acquérir des informations relatives à

un objet situé dans l'environnement d'un véhicule, et
 un itinéraire sur lequel le véhicule est destiné à circuler ; et

l'unité d'affichage (21) comprend une zone d'affichage (23) qui est transparente à l'environnement de sorte que l'environnement est visible depuis un siège de conducteur du véhicule, et est configurée pour afficher une image (AR1-AR7) superposée sur la zone d'affichage (23), **caractérisé en ce que**, lorsque le contrôleur (100) génère l'image (AR1-AR7) sur la base de l'itinéraire, le contrôleur (100) est configuré pour :

sur la base des informations, déterminer que l'objet interfère avec la circulation du véhicule dans un cas où il est déterminé qu'une distance visuelle sur la zone d'affichage (23) entre une apparence de l'objet vue depuis le siège du conducteur et l'image (AR1-AR7) est égale ou inférieure à une distance visuelle prédéterminée, la distance visuelle prédéterminée étant basée sur une taille de l'apparence de l'objet sur la zone d'affichage (23) et/ou une taille de l'image (AR1-AR7) sur la zone d'affichage (23) ; et

augmenter un rapport de la zone d'affichage (23) permettant de voir l'environnement au travers de celle-ci en modifiant une partie ou la totalité de l'image (AR1-AR7) dans un cas où il est déterminé que l'objet interfère avec la circulation du véhicule.

2. Le dispositif de traitement d'informations selon la revendication 1, dans lequel le contrôleur (100) est configuré pour déterminer que l'objet interfère avec la circulation du véhicule dans un cas où il est déterminé qu'un temps calculé de collision entre l'objet et le véhicule est égal ou inférieur à un temps prédéterminé. 5
 3. Le dispositif de traitement d'informations selon la revendication 1 ou 2, dans lequel le contrôleur (100) est configuré pour déterminer que l'objet interfère avec la circulation du véhicule dans un cas où il est déterminé qu'une vitesse du véhicule est égale ou supérieure à une vitesse prédéterminée. 10 15
 4. Le dispositif de traitement d'informations selon l'une quelconque des revendications 1 à 3, dans lequel lorsque le contrôleur (100) génère l'image (AR1-AR7) sur la base de l'itinéraire, le contrôleur (100) est configuré pour 20

déterminer si l'objet s'approche de l'itinéraire, sur la base des informations,

déterminer que l'objet interfère avec la circulation du véhicule dans un cas où il est déterminé que l'objet s'approche de l'itinéraire. 25
 5. Le dispositif de traitement d'informations selon l'une quelconque des revendications 1 à 4, dans lequel le contrôleur (100) est configuré pour augmenter une transmittance d'une partie ou de la totalité de l'image (AR1-AR7). 30
 6. Le dispositif de traitement d'informations selon la revendication 5, dans lequel le contrôleur (100) est configuré pour définir la transmittance à 100 %. 35
 7. Le dispositif de traitement d'informations selon l'une quelconque des revendications 1 à 6, dans lequel le contrôleur (100) est configuré pour réduire une taille d'une partie ou de la totalité de l'image (AR1-AR7). 40 45
 8. Le dispositif de traitement d'informations selon la revendication 7, dans lequel le contrôleur (100) est configuré pour réduire une largeur (W1) de l'image (AR1-AR7) représentant l'itinéraire, la largeur (W1) étant selon une direction de largeur d'une route sur laquelle le véhicule circule. 50
 9. Le dispositif de traitement d'informations selon la revendication 7 ou 8, dans lequel le contrôleur (100) est configuré pour réduire une longueur (H1) de l'image (AR1-AR7) représentant l'itinéraire, la longueur (H1) étant selon une direction 55
- dans laquelle le véhicule circule.
10. Le dispositif de traitement d'informations selon l'une quelconque des revendications 1 à 9, dans lequel le contrôleur (100) est configuré pour rapprocher une couleur d'une partie ou de la totalité de l'image (AR1-AR7) d'une couleur de l'environnement.
 11. Le dispositif de traitement d'informations selon l'une quelconque des revendications 1 à 10, dans lequel le contrôleur (100) est configuré pour

déterminer si l'objet est masqué par l'image (AR1-AR7) affichée dans la zone d'affichage (23), et

déterminer que l'objet interfère avec la circulation du véhicule dans un cas où il est déterminé que l'objet est masqué par l'image (AR1-AR7).
 12. Le dispositif de traitement d'informations selon l'une quelconque des revendications 1 à 11, dans lequel le contrôleur (100) est configuré pour diminuer le rapport dans un cas où il est déterminé que l'objet n'interfère pas avec la circulation du véhicule.
 13. Procédé de traitement d'informations pour commander une unité d'affichage (21) comprenant une zone d'affichage (23) qui est transparente à l'environnement d'un véhicule de sorte que l'environnement est visible depuis un siège de conducteur du véhicule, le procédé comprenant :

acquérir des informations relatives à

un objet situé dans l'environnement d'un véhicule, et

un itinéraire sur lequel le véhicule est destiné à circuler,

caractérisé en ce que le procédé comprend en outre, lors de la génération d'une image (AR1-AR7) affichée et superposée sur la zone d'affichage (23) sur la base de l'itinéraire :

sur la base des informations, déterminer que l'objet interfère avec la circulation du véhicule dans un cas où il est déterminé qu'une distance visuelle sur la zone d'affichage (23) entre une apparence de l'objet vue depuis le siège du conducteur et l'image (AR1-AR7) est égale ou inférieure à une distance visuelle prédéterminée, la distance visuelle prédéterminée étant basée sur une taille de l'apparence de l'objet sur la zone d'affichage (23) et/ou une taille de l'image (AR1-AR7) sur la zone d'affichage (23) ; et

augmenter un rapport de la zone d'affi-

chage (23) permettant de voir l'environnement au travers de celle-ci en modifiant une partie ou la totalité de l'image (AR1-AR7) dans un cas où il est déterminé que l'objet interfère avec la circulation du véhicule.

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FIG. 1

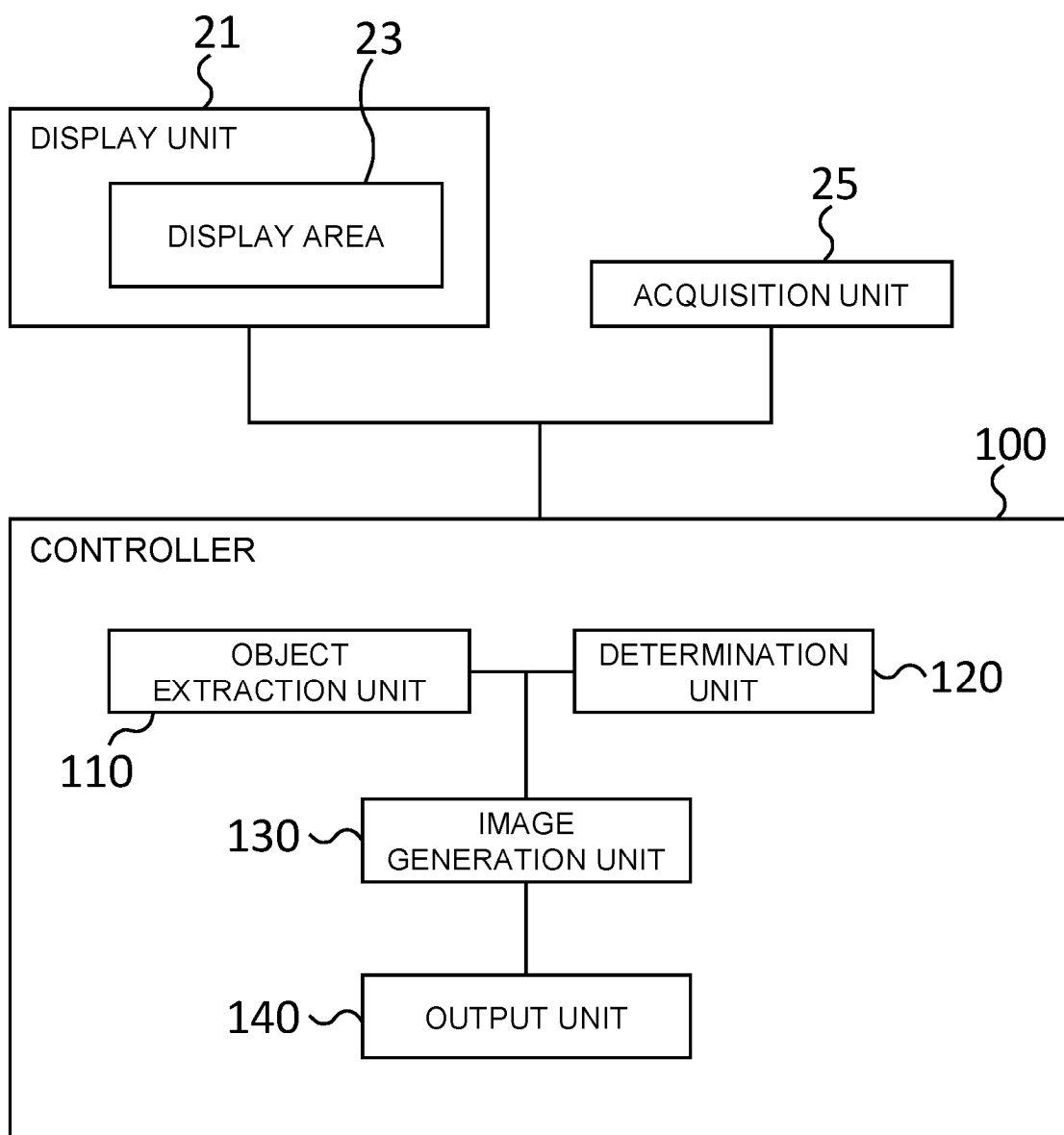


FIG. 2

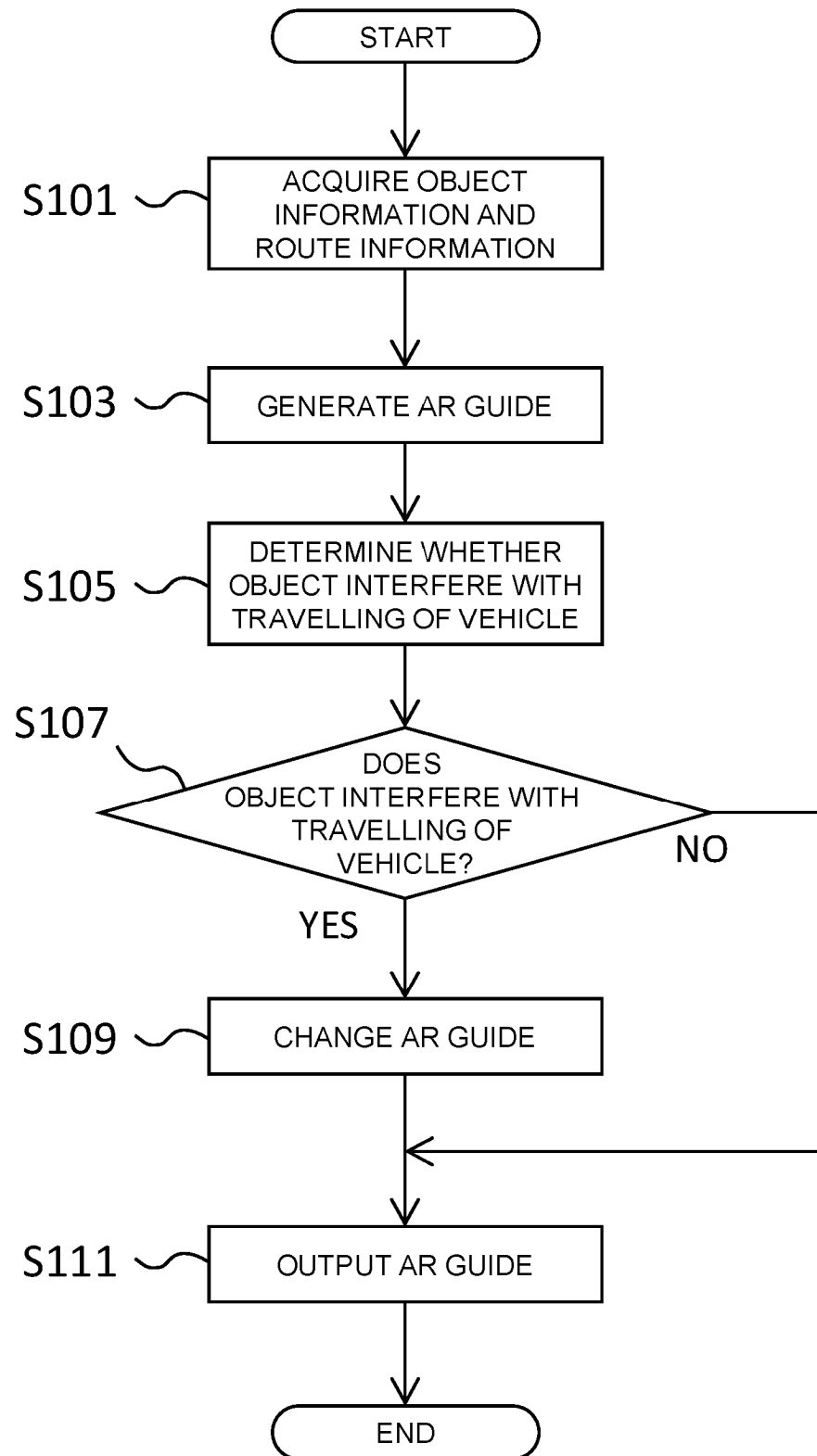


FIG. 3A

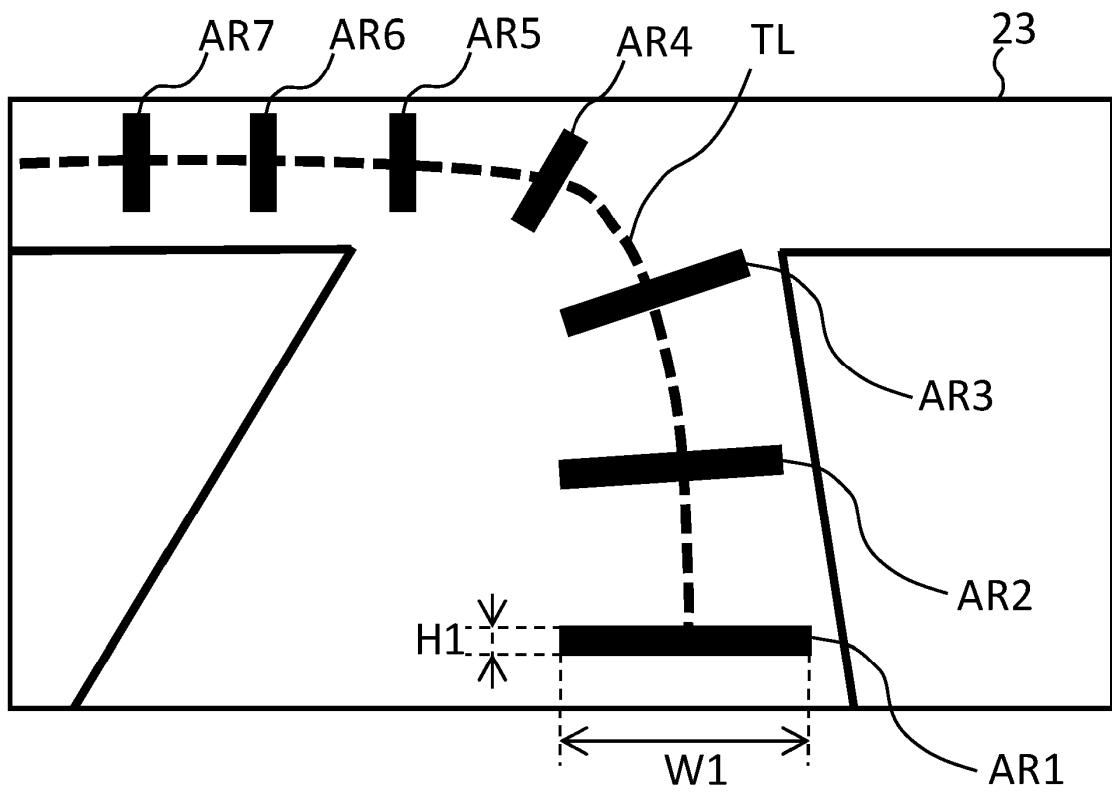
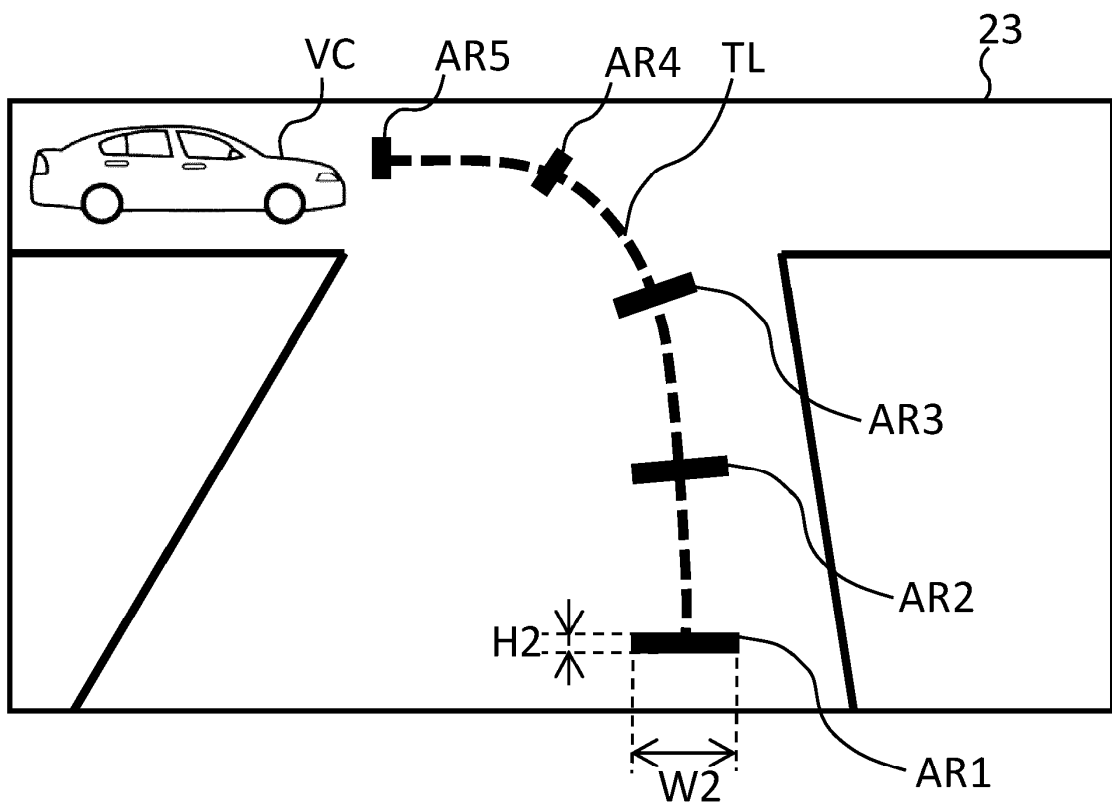


FIG. 3B



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2018070193 A [0002] [0004]
- JP 2019012236 A [0003]
- JP 2006284458 A [0003]
- WO 2018101552 A2 [0003]
- US 2016159280 A1 [0003]